Physics 1111: Lab 02
Constant acceleration 1-D motion and data fitting

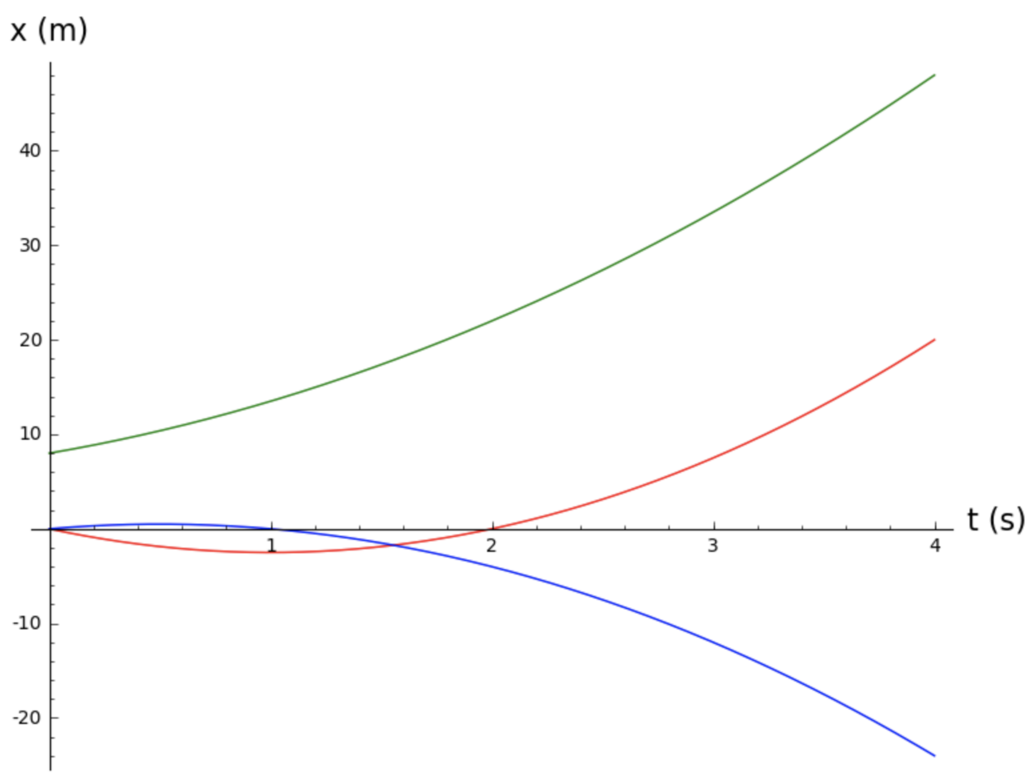
Part 1
Suppose you throw a ball straight up with initial height 1.0 m and initial velocity 2.1 m/s. Create a plot of the ball's height as a function of time (assume $t_{initial} = 0$).

Example of how to plot in SageMath:

```
t = var("t")
p1 = plot(sin(10*t) + sin(10.1*t), (t, 15, 40), color="red")
g = Graphics()
g += p1
g.show()
```

Part 2
Match each set of parameters below to one of the colored curves. Briefly justify your answers.

- $x_i = 0\ m$, $v_i = -5\ m/s$, $a = 5\ m/s^2$
- $x_i = 0\ m$, $v_i = 2\ m/s$, $a = -4\ m/s^2$
- $x_i = 8\ m$, $v_i = 4\ m/s$, $a = 3\ m/s^2$



Part 3
Now suppose you have some data collected from similar experiments on two other planets (different gravitational accelerations) (see planet1.txt and planet2.txt). Use this data to determine (a) the

gravitational acceleration of each planet, (b) the orientation of the axis used in the experiment (up or down), (c) the magnitude and direction (up or down) of the initial velocity, and (d) the starting coordinate of the ball. Use the following approach:

1. Download manfit-app.zip from https://github.com/naharrison/manual-fitter/releases, unzip it, and open the jar file.

2. From the unzipped folder, also open data/XYdata.txt and data/fitFunction.txt. Try to understand how the data in these files is being used by the application.

3. Copy the data from planet[1,2].txt into XYdata.txt. Also modify fitFunction.txt to use a function that describes an object under constant acceleration: [0] + [1]*x + 0.5*[2]*xˆ2; the lines under the function are the minimum and maximum possible values for each parameter.

4. Restart the application and tune the parameters to determine the initial position, initial velocity, and acceleration.